CT FEATURES OF PLUEROPULMONARY CHANGES IN PULMONARY THROMBOEMBOLISM

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Abstract –
Aim
This prospective analysis is carried out to study the utility of 64 slice CT in depicting the plueroparenchymal features and vascular appearances accompanying pulmonary thromboembolism and to study the significance of them.

Materials and Methods
In this study between January to June 2016, patients referred for dedicated CT angiography with symptoms related to pulmonary embolism were analysed. The suggestion/ suspicion of pulmonary thromboembolism were raised by DVT, provisional diagnosis by the clinician and positive D-dimer.

Inclusion criteria
Patients with CT angiogram showing thrombus in the main, branch or segmental and subsegmental pulmonary arteries were included in the study

Exclusion criteria
Patients with no filling defects in the main, branch, segmental or subsegmental pulmonary arteries were excluded.

Results
27 patients satisfying the inclusion criteria were included in the analysis. The presence of lung changes like the linear bands, pleural tags, mosaic attenuation, consolidation and pleural fluid are more commonly observed in acute pulmonary thrombosis. The linear bands are observed in more than half the cases.

KEYWORDS
Acute Thrombus, Infarcts, Linear Bands, Polo-Mint Sign, Pulmonary Embolism

I. INTRODUCTION
Eventhough conventional pulmonary angiogram serves as a gold standard to diagnose pulmonary thromboembolism, the multidetector CT serves as a non-invasive and easy modality to evaluate the status of pulmonary arteries upto subsegmental levels, but also combines as an eye-opener into the lung changes accompanying the pulmonary thromboembolism.

II. CT PROTOCOL
The spatial resolution of the used 64 slice CT is 0.5 mm and temporal resolution is 200msec. The studies were started with scanogram and plain serial axial sections of chest. Then the dynamic pulmonary arterial study and venous phase with 100ml of non-ionic contrast using pressure injector is done. The scanogram and plain axial cuts were carefully evaluated for lung parenchymal and vascular changes like calcification.

The images were interpreted in both lung and mediastinal windows. The dynamic arterial phase was carefully observed for filling defects either in main, branches, segmental and subsegmental arteries.

All data were systematically collected, tabulated and analysed.

III. DISCUSSION

VASCULAR CHANGES
The 64 slice CT with contrast showed acute thrombi as hypodense filling defects with a sharp interface with intraluminal contrast in all cases.

The 64 slice CT has high sensitivity and specificity in identifying thrombus upto subsegmental level arteries (fourth order). Multiplanar reconstruction images help in identifying thrombus in obliquely oriented vessels. The pitfalls may arise from insufficient contrast in pulmonary arteries and hilar nodes. The inclusion of venous imaging and multiplanar reconstruction helps in accurate diagnosis. [1,2]

The pulmonary arteries may be completely or partially occluded by thrombus. When it lies in the centre of the vessel, it forms a polo-mint sign in axial images and tram track sign in longitudinal images due to hypodense thrombi and surrounding contrast. It may also lie in the periphery. [1,2]
PULMONARY CHANGES

The changes in the lung that accompany the pulmonary embolism either in the main pulmonary artery or its branches vary from airspace opacities, centriflobular nodules, consolidation, linear bands, subpleural thickening and pleural tags. Pleural effusion is also seen in some cases. Even though the lung findings are non-specific for the diagnosis of pulmonary thromboembolism, in an appropriate clinical setting, the patient may be further evaluated by a repeat CT angiogram or scintigraphy.

IV. RESULTS

Within a period of 6 months (Jan-June 2016), the studied 27 cases of pulmonary thromboembolism revealed, linear bands more commonly than pleural tags, pleural effusion, bilateral diffuse mosaic attenuation. Subpleural thickening, consolidation, centriflobular nodules and peribronchial thickening were observed in few cases.

TABLE 1: TABLE SHOWING THE NUMBER OF CASES FOR EACH LUNG FINDING

<table>
<thead>
<tr>
<th>S.no</th>
<th>Lung findings</th>
<th>No of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Linear bands</td>
<td>16</td>
<td>59</td>
</tr>
<tr>
<td>2.</td>
<td>Pleural tags</td>
<td>8</td>
<td>29</td>
</tr>
<tr>
<td>3.</td>
<td>Pleural effusion</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>4.</td>
<td>Mosaic attenuation</td>
<td>5</td>
<td>18</td>
</tr>
<tr>
<td>5.</td>
<td>Subpleural thickening</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>6.</td>
<td>Consolidation</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>7.</td>
<td>Centrilobular nodules</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>8.</td>
<td>Peribronchial thickening</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>9.</td>
<td>Infarcts</td>
<td>6</td>
<td>22</td>
</tr>
</tbody>
</table>

Mosaic attenuation were seen in 5 cases constituting 18% of cases due to differences in perfusion. They are seen in both acute and chronic thrombosis.

In chronic pulmonary embolism, the size and number of subsegmental pulmonary arteries appear reduced. It may be seen as a peripheral hypodensity draping the pulmonary arterial wall or as a thickened artery. Webs or flaps may also be seen.[2]. Other findings include bronchial artery hypervascularisation, cardiomegaly with right ventricular dilatation and reflux of contrast into IVC and hepatic veins.[3]

Increased lung lucency with paucity of vessels was seen in a case of chronic thromboembolism. The lung lucency should be distinguished from emphysema and bronchiolitis obliterans.
Fig 5.6: Left upper lobe oligemia with right pulmonary thrombus
Wedge shaped air-space densities were seen in 6 cases constituting 22% of cases. It resolved completely in 6 weeks in one of the patients on follow-up CT angiogram suggesting consolidation.

One patient showed decrease in size of the density in par with melting ice sign in the periphery suggestive of infarct. Infarct was seen in 3 cases constituting 12% of cases. Lab parameters like D-dimer were seen starting to reduce in par with the melting ice sign.

In another case of acute on chronic thromboembolism, bronchial artery hypervascularisation was present.

Fig 7: Infarct with central lucency, right pleural fluid
One case of acute on chronic pulmonary thromboembolism showed two infarcts. One of the infarct showed air-fluid levels with surrounding centrilobular nodules with tree-in-bud appearance suggestive of secondary infection leading to cavity transformation. Acute infarct with few lucencies were also seen.

A case of young stroke with homocystinuria, showed acute infarct in upper lobe. The upper lobe vessels were completely occluded by thrombus extending from near completely occluded right pulmonary artery.

Fig 8: Acute infarct with enlarged bronchial artery
Out of the 6 cases, 5 cases were acute on chronic thromboembolism. The remaining case was that of acute pulmonary embolism Peribronchial thickening was seen in 1 case. It may be due to edema. Centrilobular nodules were seen in 2 cases of chronic pulmonary thromboembolism.
Subpleural thickening was seen in 3 cases.

Linear bands were seen in 16 of the cases, a significant mode, constituting 59% of cases. They are often multiple and tend to predominate in lower lobes. They are seen on either side independent of the side of infarct. They occur in both acute and chronic pulmonary thromboembolism. Linear bands have been an eye-opener to suspect pulmonary embolism even though it is non-specific and can occur in many other conditions. It may represent focal atelectasis. The linear bands predominated in acute cases.
Fig 9,10,11: Linear bands in both lower lobes
Apart from lung, pleura also reacted with pleural tags and effusion.
Pleural tags were seen in 8 of the cases, constituting 29% of cases.
Pleural effusion was seen in 4 cases, constituting 15% of cases. The effusions commonly occur in the side of thrombus. When the thrombus is seen bilaterally, the pleural effusion occurred on the side of acute thrombosis.

V. CONCLUSION
The presence of lung changes like the linear bands, pleural tags, mosaic attenuation, consolidation and pleural fluid are more commonly observed in acute pulmonary thrombosis. The linear bands are observed in more than half the cases. Even though they are non-specific to pulmonary embolism, these findings in the absence of fever alerts the radiologist to look for the possibility of pulmonary embolism in patients with breathlessness, chest pain and deep venous thrombosis. The presence of centrilobular nodules, peribronchial thickening and air-space opacities are less commonly associated with pulmonary thromboembolism.
These lung features are non-specific for pulmonary thromboembolism and appears to be positive for many other differentials. The lung ventilation-perfusion scintigraphy stands as a prime modality for diagnosing pulmonary thromboembolism. Multidetector CT angiography plays a major role to evaluate pulmonary thromboembolism by depicting the lung findings.

REFERENCES